

SECOND EVALUATION

Christine Bourbonnais-Hendley

From: Christine Bourbonnais-Hendley
Sent: Friday, February 01, 2013 4:27 PM
To: nali065@uottawa.ca
Cc: gc@kin.umass.edu; Michel Labrosse; elemaire@ottawahospital.on.ca; Gordon Robertson; 'Michael Pierrynowski'; grouhi@uottawa.ca; Benoit Seguin; FSS Recherche; hksecr
Subject: Evaluation of your revised thesis
Attachments: DOC.PDF; DOC.PDF; DOC.PDF

Good afternoon Mr. Ali,

The Faculty of Graduate and Postdoctoral Studies (FGPS) has received four evaluation reports of your revised thesis. I regret to have to inform you that the examiners have found that even with additional extensive revisions, your thesis still fails to meet the standards for a doctoral degree. Please find, in attachment to this email, a letter from Dean Hastings, the procedures for an appeal and the comments from the evaluation of your revised thesis.

If you have any questions, please do not hesitate to contact our office.

Regards,

Christine B. Hendley
Gestionnaire des services aux étudiants et aux facultés (2^e et 3^e cycles)
Manager of Services to Graduate Students and Faculties
Faculté des études supérieures et postdoctorales /
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uOttawa

Université d'Ottawa
Faculté des études supérieures
et postdoctorales

University of Ottawa
Faculty of Graduate and
Postdoctoral Studies

January 30, 2013

Mr. Nicholas Ali
306 – 589 Rideau Street
Ottawa ON K1N 6A1
Nali065@uottawa.ca

Dear Mr. Ali:

The Faculty of Graduate and Postdoctoral Studies (FGPS) has received four evaluation reports of your revised thesis. I regret to have to inform you that the examiners have found that even with additional extensive revisions, your thesis still fails to meet the standards for a doctoral degree. According to FGPS regulations you must withdraw from the program and your file will have to be closed.

You may appeal this decision to the Executive Committee of the FGPS by writing to Dr. Margaret Moriarty, Secretary General of the FGPS (University of Ottawa, Hagen Hall, Room 105, 115 Seraphin-Marion, Ottawa ON K1N 6N5) within 10 working days following receipt of this letter. Please refer to paragraph 10 of the enclosed document on Appeal Procedure.

In order to help you with your decision, I have also enclosed a copy of the four reports.

I deeply regret the disappointment this news will cause you.

Yours sincerely,

Ross Hastings, Ph.D.
Acting Dean

c.c. D. Benoit
E. Lemaire
B. Séguin

G. Caldwell
G. Robertson
L. O'Reilly

M. Labrosse
G. Rouhi
N. Carter

Encl.

Regulation of the Faculty of Graduate and Postdoctoral Studies (FGPS) - University of Ottawa
REVISION OF MARKS

PREAMBLE

1. The University recognizes the right of all students to see, on request, all tests, assignments or examinations after they have been marked.
2. Graduate students who are not satisfied with a mark they have obtained should first approach the professor and, if necessary, the director of graduate studies of the department concerned to request a revision of the mark assigned.

APPEAL PROCEDURE

1. Graduate students may appeal the attribution of any mark for any written test, assignment or examination with which they are dissatisfied, provided they submit to the Dean of the Faculty of Graduate and Postdoctoral Studies a written request for revision within four weeks of the first communication of the mark in question.

Such a request shall include:

- a. the title of the course, an identification of the assignment, test or examination in question, the mark obtained and the name of the professor (or professors) whose mark is in question;
 - b. a statement of the grounds of the appeal.
2. A copy of the student=s request shall be forwarded to the professor, who may submit written comments to the Dean.
3. Two weeks after the receipt of the student=s request, the Dean shall appoint one or two qualified evaluators to re-assess the assignment, test or examination in question.
4. The evaluators shall be provided with a copy of the student=s request and of the comments of the professor. They shall review the entire assignment, test or examination in question and provide the results of their individual evaluations to the Dean as soon as possible.
5. The Dean, in the light of all evaluations, shall determine the revised mark, which may be identical to, lower or higher than the original one.
6. The Faculty of Graduate and Postdoctoral Studies shall inform the student by letter of the result of the appeal within a reasonable time of receiving the report of the evaluator(s). A copy of the letter shall be sent to the professor whose mark was appealed.
7. A student cannot withdraw such an appeal once the revised mark has been assigned.
8. An appeal from the revised mark may be made to the Senate Committee for the Study of Individual Cases, either by the student or by the professor, on the grounds that the evaluation was not properly carried out. Unless exceptional circumstances are shown, such an appeal must be made within two weeks of the date of the letter informing the student of the mark assigned as a result of the re-evaluation. If the appeal is successful, the Faculty of Graduate and Postdoctoral Studies shall be directed to proceed to a new evaluation, the results of which shall be final and binding.
9. Nothing in this procedure prevents a student from discussing examination questions, including the type of answers expected, with the professor and/or the department concerned. Such consultation is not a prerequisite to, nor can it be used to extend the time limit provided for in article 1.
10. Comprehensive examinations, thesis evaluations and thesis defences, being conducted by a panel of examiners in accordance with established procedures, are not subject to the appeal provisions of this regulation. Their decisions may, however, be appealed to the Executive Committee of the Faculty of Graduate and Postdoctoral Studies, which, depending on the nature of the complaint, will take appropriate action to ensure that it is clear that justice has been done. If the student is not satisfied with the outcome of such action, he may appeal to the Senate Committee for the Study of Individual Cases on the grounds that appropriate procedures have not been followed.



THESIS EXAMINER'S REPORT FOR A
REVISED THESIS

Version française : Rapport d'évaluation pour
une thèse remaniée

NAME OF STUDENT <i>Nicholas Ali</i>	STUDENT NUMBER <i>5033260</i>	DOCTORAL THESIS ☒	MASTER'S THESIS ☐
DEGREE <i>PhD</i>	ACADEMIC UNIT <i>School of Human Kinetics</i>		
TITLE OF THESIS <i>Predicting Risk factors of Non Contact ACL Injuries during Single leg Landing</i>			
NAME OF THESIS SUPERVISOR <i>Dr Gordon Robertson</i>		NAME OF THESIS CO-SUPERVISOR <i>Dr Ghulamreza Roubi</i>	
NAME OF EXAMINER <i>Dr Edward Lemaire</i>		DEADLINE FOR SUBMISSION OF REPORT <i>Friday Sep 7, 2012</i>	
INSTRUCTIONS FOR EXAMINERS			
PART A: EVALUATION / Tick off the choice that best describes your evaluation of the revised thesis. PART B: COMMENTS / Provide your comments for each of the topics listed. PART C: RECOMMENDATION FOR A PRIZE / Indicate your decision and complete the attached form if recommending thesis for a prize. PART D: SIGNATURE / Sign and date the form PART E: DOCUMENTS / Return necessary documents.			
PART A: EVALUATION			
CRITERIA			
DOCTORAL THESIS: THE THESIS must constitute a significant contribution to knowledge, embody the results of original investigation and analysis by the student and be of such quality as to merit publication. MASTER'S THESIS: THE THESIS should demonstrate that the candidate is able to work in a scholarly manner and is acquainted with the principal works published on the subject of the thesis. Insofar as it is possible, the thesis should be an original contribution.			
VERDICT			
1	☐	The revised thesis <u>is accepted</u> for the defence. - The revised thesis meets the evaluation criteria listed above. - Required changes are limited to correcting occasional grammatical or spelling errors, formatting problems or to minor redundancies or omissions (e.g., transitional paragraphs, notes).	
2	☐	The revised thesis <u>is accepted</u> for the defence but additional changes are required <u>AFTER DEFENCE</u>. - The quality of the presentation is acceptable and the necessary changes will not have an impact on the defence. - During the defence, the jury will determine which additional changes are necessary and who will be responsible for ensuring they have been completed and for approving the thesis.	
3	☒	The revised thesis <u>still cannot be accepted for the defence</u> and must undergo additional extensive revision <u>BEFORE DEFENCE</u> to ensure it meets the above criteria. - There are still problems with the interpretation of results or the theoretical or methodological approach, but the thesis may meet the criteria if substantial changes are made. - The presentation of the revised thesis is still not acceptable (numerous grammatical or spelling errors, evidence of carelessness, etc.). In this case, the revised thesis is returned to the candidate to complete additional revisions, corrections and changes. The candidate must submit a new revised version of the thesis to the examiners. The examiners must judge the changes satisfactory before the thesis can proceed to the defence stage. If more than one examiner chooses this verdict for the revised thesis, the student must withdraw from the program.	
4	☐	The revised thesis <u>still fails to meet the standards required</u> for the degree. - The work was not done in accordance with established methodology employed in the discipline. - The thesis still does not exhibit the candidate's capacity to meet the scholarly standards required. - Even with additional extensive revision, the thesis would not meet the standards required for the degree. By choosing this verdict, the examiner recommends the student withdraw from the program. If more than one examiner chooses this verdict for the revised thesis, the student must withdraw from the program.	
NOTE: Your feedback will have an impact on how the candidate prepares for the defence, the dean's decision if the jury is divided and the awarding of prizes. Please be sure to complete Section B regardless of your verdict.			

PART B: COMMENTS

Please provide your comments on each of the topics below in a separate document. If the thesis is accepted for the defence (see verdicts # 1 and # 2, above), your comments will be sent to the candidate and the thesis supervisor without reference to your identity. If major revisions are required before the defence (see verdict # 3, above), a signed copy of your comments will be provided to the student, the supervisor, as well as to all members of the jury and the chair of the academic unit.

- UNDERSTANDING OF THE SUBJECT MATTER
- CONTRIBUTION OF THE THESIS TO ADVANCING KNOWLEDGE
- RESEARCH METHODOLOGY
- ANALYSIS OF RESULTS AND VALUE OF CONCLUSIONS
- ORGANIZATION, WRITING STYLE AND PRESENTATION OF MATERIAL
- REVISIONS CONSIDERED NECESSARY IN ORDER FOR THESIS TO BE ACCEPTED
- GENERAL COMMENTS

Your comments and explanations are extremely important and will:

- help the student prepare for the defence or make necessary revisions to the thesis (if revisions are required before the defence, a signed copy of your comments is provided to the candidate, the thesis supervisor, as well as to all members of the jury and the chair of the academic unit);
- allow the dean of FGPS to make an informed decision if the jury is divided; and
- allow the FGPS selection committee to choose recipients of prizes and medals.

PART C: RECOMMENDATION FOR A PRIZE

DO YOU RECOMMEND THIS THESIS FOR A PRIZE?

- (☒) YES – Please complete the attached NOMINATION FOR THESIS PRIZE form.
(☐) NO

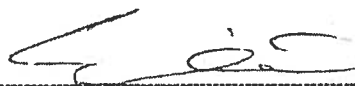
The absence of a reply will be considered a NO.

PART D: SIGNATURE

DATE

Sept 11, 2012

SIGNATURE



PART E: DOCUMENTS

DOCTORAL THESIS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed self-addressed envelope to:

Thesis Sector
FGPS
Hagen Hall
115 Séraphin-Marion, Room 107
Ottawa ON K1N 6N5

MASTER'S THESIS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed envelope to your academic unit.



THESIS EXAMINER'S REPORT

NAME OF STUDENT Nicholas Ali		STUDENT NUMBER 5033260	DOCTORAL THESIS ☒	MASTER'S THESIS ☐
DEGREE Ph. D.		ACADEMIC UNIT School of Human Kinetics		
TITLE OF THESIS "Predicting Risk Factors of Non-Contact Anterior Cruciate Ligament Injuries During Single-Leg Landing"				
NAME OF THESIS SUPERVISOR Dr. Gordon Robertson		NAME OF THESIS CO-SUPERVISOR Dr. Gholamreza Rouhi		
NAME OF EXAMINER Dr. Edward Lemaire		DEADLINE FOR SUBMISSION OF REPORT Friday, September 7 2012		
INSTRUCTIONS FOR EXAMINERS				
PART A: EVALUATION / Tick off the choice that best describes your evaluation of the thesis. PART B: COMMENTS / Provide your comments for each of the topics listed. PART C: RECOMMENDATION FOR A PRIZE / Indicate your decision and complete the attached form if recommending thesis for a prize. PART D: SIGNATURE / Sign and date the form PART E: DOCUMENTS / Return necessary documents.				
PART A: EVALUATION				
CRITERIA				
DOCTORAL THESIS: The thesis must constitute a significant contribution to knowledge, embody the results of original investigation and analysis by the student and be of such quality as to merit publication. MASTER'S THESIS: The thesis should demonstrate that the candidate is able to work in a scholarly manner and is acquainted with the principal works published on the subject of the thesis. Insofar as it is possible, the thesis should be an original contribution.				
VERDICT				
1	☐	The thesis is accepted for the defence. - The thesis meets the evaluation criteria listed above. - Required changes are limited to correcting occasional grammatical or spelling errors, formatting problems or to minor redundancies or omissions (e.g., transitional paragraphs, notes).		
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3	☒	The thesis cannot be accepted for the defence and must undergo extensive revision BEFORE DEFENCE to ensure it meets the above criteria. - There are problems with the interpretation of results or the theoretical or methodological approach, but the thesis may meet the criteria if substantial changes are made. - The presentation of the thesis is still not acceptable (numerous grammatical or spelling errors, evidence of carelessness, etc.). In this case, the thesis is returned to the candidate to complete the required revisions, corrections and changes. The candidate must submit a revised version of the thesis to the examiners. The examiners must judge the changes satisfactory before the thesis can proceed to the defence stage.		
4	☐	The thesis still fails to meet the standards required for the degree. - The work was not done in accordance with established methodology employed by the discipline. - The thesis does not exhibit the candidate's capacity to meet the scholarly standards required. - Even with extensive revision, the thesis would not meet the standards required for the degree. In this case, the candidate may be asked to withdraw from the program.		
NOTE: Your feedback will have an impact on how the candidate prepares for the defence, the dean's decision if the jury is divided and the awarding of prizes. Please be sure to complete Section B <u>regardless</u> of your verdict.				

PART B: COMMENTS

Please provide your comments on each of the topics below in a separate document. If the thesis is accepted for the defence (see verdicts # 1 and # 2, above), your comments will be sent to the candidate and the thesis supervisor without reference to your identity. If major revisions are required before the defence (see verdict # 3, above), a signed copy of your comments will be provided to the student, the supervisor, as well as to all members of the jury and the chair of the academic unit.

- UNDERSTANDING OF THE SUBJECT MATTER
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- GENERAL COMMENTS

Your comments and explanations are extremely important and will:

- help the student prepare for the defence or make necessary revisions to the thesis (if revisions are required before the defence, a signed copy of your comments is provided to the candidate, the thesis supervisor, as well as to all members of the jury and the chair of the academic unit);
- allow the dean of FGPS to make an informed decision if the jury is divided; and
- allow the FGPS selection committee to choose recipients of prizes and medals.

PART C: RECOMMENDATION FOR A PRIZE

Do you recommend this thesis for a prize?

☒ YES -- Please complete the attached NOMINATION FOR THESIS PRIZE form.
☐ NO

The absence of a reply will be considered a NO.

PART D: SIGNATURE

DATE

Sept 11 / 2012

SIGNATURE



PART E: DOCUMENTS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed self-addressed envelope to:

Thesis office
FGPS
Hagen Hall
115 Séraphin-Marion, Room 107
Ottawa ON K1N 6N5

Nicholas Ali – Thesis Review

Understanding of the Subject Matter

The student has made progress in his understanding of the subject matter; however, the statistical analysis of the data and conclusions raised from the methods and results indicate that an improved understanding of various research aspects is needed. The thesis is written as if correlations imply a “cause and effect”, which is not the case.

Contributions of the Thesis

This thesis expands on the data collected in past research but the outcomes did not provide additional information to our understanding of single leg landing (i.e., jumping higher or farther increased GRF and people flex their lower limbs more). The model has validity concerns and the statistical analysis approach is questionable.

Research Methodology

The methodology and conclusions typically do not match up, with conclusions being made that are not supportable by the study methodology. Statistical approaches are questionable for some aspects of this study. The majority of issue are with Paper 5, followed by Paper 4.

Analysis

As mentioned above, issues in the 3 research papers remain concerning the results and the conclusions. While better than the last version, tables of outcome data are still required for some results.

Organization, Writing Style

The writing style is adequate, with various suggested edits listed in the document. Improvements in figures are required to facilitate data evaluation.

Overall Revisions and Comments

- The responses have not changed my perspective that the “AI” approach paper should be removed from the thesis. This idea has not been implemented or evaluated and the feasibility of accomplishing this idea is questionable. A short summary of this idea could be included in the future work section of the thesis.
- Formatting discrepancies exist throughout the document. Please follow one format. Various wording/format edits are marked in the text. Margin format is incorrect (left margin too small)
- This document summarizes issues with the paper. Specific edits are listed on the paper copy.

- After reading the thesis it seems as if the correlations are performed on all 9 conditions, which makes interpretation difficult since some factors are more sensitive to height rather than distance changes.

Abstract

- A statement is made that few studies look at different heights and distances for single leg landing; however, this may be because the existing studies answer the research question
- Objective 2, a new approach, is not used in the rest of the thesis. Therefore, the proposed approach is questionable (i.e., if the idea is appropriate, why not use this approach?)
- For the final question, if females have a higher rate, then it is obvious that gender differences exist
- #3: the comment was to use be specific when referring to risk factors, since the readrt often has difficulty knowing what factors are being discussed. The author's response indicates that the comment was not understood.
- #4: the author's only argument about not using this proposed method is that other people with more money, equipment, skills, and resources could try. This is not a valid reason and would indicate that the proposed method is not feasible.
- #10: the comment was that the impact of negating arm movements should be considered in the discussion. A PhD candidate should be able to understand the biomechanical influence that are introduced by the selected methods. From the response, it is unclear whether the candidate understands that not allowing the participants to use their arms changes the task. The last comment seems to indicate that the arms are not useful for adding moments to affect body motion, which is untrue.
- #12: This study looks at landings, so the candidate should have an understanding of the loads when someone lands, from a variety of takeoff methods. For example, the candidate should be able to report the range of lower limb kinetic and kinematic values for these landings and discuss where the thesis results fit into this range. Jump and drop can both be single leg landings

Background

- Page 1: The author indicated that the best method for ACL injury analysis is simultaneously addressing multiple risk factors, but this was not done. So why was this not attempted?
- Page 2: "simulate a 3D rigid body model in Visual3D", reword since the model was not simulated by an actual "3D rigid body model"
- Page 3: this study does not use "whole body movement" for the loading task since the arm movement was constrained

Questions

- Risk factors for ACL injury: How can you identify injury risk factors when no injury occurred? How can you be sure that the same loading patterns would exist in an injury situation? This question needs to be replied since it is not related to the methods.

- Gender: Similarly, the same issues come up for the gender injury statement
- Multifactorial: This question and section should be removed

Objectives

- #3: what is meant by “significantly impacted by main effects”? Please reword.

Rationale

- The rationale is based on the idea that few studies exist in the target area so more studies should be done. However, the candidate does not convince the reader why these additional studies are needed? For example, if previous landing studies showed that forces, moments, and joint angles increase as the person jumps from a higher point or jumps further; why do we need another study to show that this results is consistent as the person adds height or distance? Was this previous outcome in question?
 - Each statement should be rewritten to provide a reason for the research beyond the number of published studies

Importance

- This section was written as if the outcomes involve ACL injury. In the current state, this thesis provides a description of single leg landing biomechanics at longer-higher distances. The outcomes will not have an impact on the items mentioned in section 1.5. This section should be rewritten to indicate how the actual outcomes of the research are important.
- Page 15, section 1.13: A discussion of ways to integrate data should come after you have developed a reliable method for collecting the input data. Considering ethics and current measurement technology, it is unclear how all risk factors, forces, and injury mechanisms could be measured during an injury.
- Page 17: AI is not used for movement pattern capture
- Page 17: It is not clear how AI is proposed to being used from section 1.13. What output do you expect from the AI model? This section seems to indicate that you can take 5 areas (athletic interviews, clinical studies, video analysis, computational modelling) to predict the mechanisms and risk factors of injury. This was not done in the thesis so this sections does not cover the “Role of AI in this research”
- Page 17, 1.14: Muscle models only estimate muscle forces, not determine.
- Page 18: Section 1.15 should be rewritten to include details of the scope without having to read the papers to understand this section (ex., “This gap in the knowledge” is stated but the reader is not know what gap is being mentioned).

Paper 1

- No indents for paragraphs
- As indicated in the original comments, the proposed MDO is not well supported in this paper. The author describes the problems and errors existing in current methods, but then suggests to bring these inaccurate methods together through an AI optimization method to determine when the ACL stress exceeds the ultimate tensile strength. Considering that the author acknowledges that “there

are no known body kinematic data or muscle data that precisely address position of the body at ACL injury", as well as the numerous other problems with modelling humans, you are left with a method that may not be possible to implement successfully.

- Based on the lack of evidence to support the proposal, and that the method was not used in this thesis, this paper can be removed without affecting the thesis. In fact, removal with improve the thesis be removing this line of thought, that is a distraction from the project focus on jump landing biomechanics.

- Page 20, chapter 4: how was the data used to develop the model used for Visual 3D?
- Page 32: Can you prove that computing power or software was a limitation in past research? If yes, add references, if not, please remove. In addressing this, please consider recent literature (i.e., last 10-15 years) since we can assume that some papers in the 1970's may have had poorer computing resources.
- Page 33: Phrases such as "the associated contributing risk factors of injury" have been used in this thesis, but it is unclear to the reader what these factors include. Please define these associated factors, with examples. This was not changed from the first review.
- Page 33: Multidisciplinary is "Combining or involving several academic disciplines or professional specializations in an approach to a topic or problem". You have mentioned multifactoral previously but not multidisciplinary ... is multidisciplinary the term you wish to use? If yes, then you should expand to tell the reader what disciplines should be working together on the problem, etc. I believe that some research groups include engineers, biomechanists, and physicians, so multidisciplinary research has been undertaken.
- Page 38: You defined video analysis is defined as qualitative and thereby excluded; however, could new automated video analysis technology be used to provide relevant quantitative information on ACL injury? For example, if you could have multiple cameras tracking soccer players in realtime until someone suffers an ACL injury, would you be able to extract useful quantitative total body information?
- Page 39: The sentence "contact methods ... have the advantage of simultaneously ...", what risk factors are included? The response to the initial comment was that the read took this out of context ... therefore you should revise the sentence or paragraph so that this does not happen.
- Page 41: As mentioned in the original comment 34, this sentence should be changed or revised. The "tissue" advantage of in vitro is not obvious in the context of the thesis and paragraph.
- Page 41: The comment #37 was not changed in the text. You defined "freedom" in the response but did not modify the text. You are "more free" with cadavers or simulations to load the limb to failure than with gait studies, so your overall "freedom" comment lacks the required specificity.
- Page 44: Comment 41 was not address in the text. The sentence should be reworded since the teaching problems are not supported.
- Page 44: The statements that problems stem from universities ..., and private sector funding and not supported. More detail is needed to explain these statements.
- Page 44: Perhaps you should consider that modelling humans is difficult and lack of advancements is because of too used for new innovative ideas, technologies, etc.

- Page 47: In the method you assume one solution to the optimization method. If you continued to vary the input you may come up with many input parameter options that achieve the within-error test. How would you handle these?
- Page 48: It is not clear how the proposed method would “reduce equipment needs, number of subjects, and testing time”. To apply this method you would have to MRI scan each subject, perform all the modelling, and still collect the 3D motion data. Otherwise, you are just applying and scaling another generic model, of which others currently exist.
- Page 48: an “enabling tool” is mentioned to capture all the required data; however, the author does not describe this tool. If no detail can be provided, then this section should be removed.

Paper 2

- Comment #55: “The paper has already been published” is not an acceptable answer. Valid comments should be addressed in the text to improve the thesis document.
- Comment #58: The statement about simulated annealing not being clear is incorrect since it is well described in McLean 2008. If you are talking about another paper, please revise this section for clarity.
- Comment #60: No Figure 2 was found for Paper II.
- Page 81: An “instrumented prosthesis” is mentioned but no details are included about this device and how it could provide valid data for the target application
- Comment #64: The response to this comment does not answer the comment. Many of the inputs to the AI model would be estimates, so error accumulation would be expected. AI will only be useful

Paper 3

- Comment #90: The response seems to indicate that the findings in the literature should not be used to understand the effects of landing. Even though different methods are used, the results from different studies that report loading should be considered and they do provide information to understand knee moments for different landing situations. Therefore, data is not lacking and these results should not be ignored. Based on your response, my comments during the proposal phase were largely ignored.
- Page 90: “ This knowledge provides ... ”. What are you referring to by “This knowledge”? Attenuation of GRF? The knowledge provided by the study shows that load increases if you jump higher and farther and people flex their joints more to dissipate these forces. This does not provide insights into ACL injury risk. Therefore, this sentence can be removed.
- Page 91:
 - “increasing the body’s angular momentum” . You are also increasing velocity for the increased horizontal distance, and thereby increasing momentum, as with the previous comment. Better to remove “angular” since linear momentum is likely also increased.
 - “Given this, the current study ...” Since this study does not test ACL injury risk, these sentences should be revised. The previous study could be revised to say “ ... a factor in ACL injury, therefore this measure was included in the research”.
 - Same for next “Given this ...” sentence

- Page 92: Other studies provide useful horizontal landing info. You should review these ...
 - JJ Van der Harst, A Gokeler, AL Hof - Clinical Biomechanics, 2007, Leg kinematics and kinetics in landing from a single-leg hop for distance. A comparison between dominant and non-dominant leg
 - KJ SIMPSON, L KANTER - Medicine & Science in Sports & Exercise, 1997, Jump distance of dance landings influencing internal joint forces
 - WQ Marquez, M Masumura, M Ae - Sports Biomechanics, 2009, The effects of jumping distance on the landing mechanics after a volleyball spike (2 leg landing but same outcomes as your study)
- Page 92:
 - "... heights lower than 30 cm ..." several studies use vertical heights over 30 cm, therefore this sentence should be revised. The current sentence leads the reader to believe that there is a gap in the literature for investigations of >30 cm vertical height.
 - "... relationship between vertical landing height and horizontal ...", your study also did not investigate this, since the horizontal distance was set for vertical landings and vertical height was set for horizontal landings. Make sure that the text is not written so as to mislead the reader that this aspect is covered in the study.
 - Other studies investigated multiple joint kinematics, so how can you state that these studies did not consider the contributions of other limbs?
 - "... is important for predicting risk ...", since you are not predicting risk in this study it is better to remove this sentence.
 - What were the hypotheses for horizontal jumps?
- Page 93: Did you really use Plug-in gait or a 6DoF marker set? Plug-in gait has strict requirements for how the markers need to be arranged, and this marker set typically produces errors at the shank and foot during deep knee bend landings. Visual3D typically does not have automatic calculation of the Plug-in-Gait model.
- Comment #77: It is unclear why the recommendation to use "maximum" instead of "peak" was ignored and that the term "maximum" was considered "not valid". Even if there is only one peak, it is better to use the most descriptive term when writing. Therefore, if you are recording the maximum, say maximum, if you are recording the peak force at pushoff, then "peak" would be appropriate. For example, in figure 3, the first peak is the maximum and the subsequent peaks relate to perturbations during load acceptance.
 - The response to the 0.8s as including the takeoff contradicts the paper where you state "The landing phase was defined as 0.8 ..." (page 95). Therefore this is the "takeoff and landing phase". You may want to indicate that this approach increases the work value since you are also incorporating negative knee power during standing and takeoff, but that these additional work values are small compared to the loading response work and therefore should have little effect on the work data used for analysis.
 - You should have use event codes in Visual3D to identify landing and successful recovery and then perform the analysis between these events

- Since you used 3D analysis, do not define the kinetic as “sagittal plane”. The knee likely moved out of the sagittal plane during landing. I believe that you analyzed joint flexion, so you can use this terminology.
- Page 96: Add PPMC to list of abbreviations
- From table 1,
 - post-hoc analysis could have shown no difference between 20 cm and 40 cm for trunk flexion ... or that trunk flexion decreased before increasing for 60 cm. This should be investigated in the results and discussion.
 - Likewise for PGRF (called HGRF in the table, please use consistent acronyms), post hoc analysis could have showed no difference between 20 cm and 40 cm, but the statistical test is needed to confirm. From figure 2, some people had similar or lower values at 40 cm (4 similar, 3 >, 3 <). If the one outlier with the largest PGRF forces was removed, significance could disappear between 20 and 40 cm.
- From figure 1, it is interesting that the range of values was large (approx. 3 BW). This range could be reported since these outliers could be the important ones when you look at knee injury. What was the body weight for the people at the top and bottom of the VGRF results? Was there a difference in joint kinematics for these people, as compared to the mean?
- Please combine Table 2 and 4 to include PGRF correlations in a separate column, and remove the linking lines. You can mention the additional comparisons in the text (current method shows significance but no correlation values).
 - Interestingly, ankle and knee correlations were negative, so when the VGRF increased knee angle decreased? This seems to contradict the results but is a consequence of the sign convention for knee and ankle angles (i.e., increasing negatively).
- In figure 4, it is interesting that the horizontal GRF is in the opposite direction for vertical landings at VGRFmax. It is hard to discriminate the various curves at VGRFmax, but some PGRF seem to be negative and some positive, which doesn't match up with the table. Please edit the document to better indicate how you calculate the horizontal GRF (negative is force directed away from the start point, did you take absolute value of this breaking force or measure the positive force?). Since the PGRF and VGRF maximums did not occur at the same point, should the horizontal tests have used the time at PGRFmax to calculate the other parameters?
- VGRFmax occurs at foot-flat (fig 5a)
- Comment #80: the guidelines of >0.5 being a strong correlation are not typically followed, please see my previous comments and these sites ... many more if you search “correlation interpretation strong”
 - <http://faculty.quinnipiac.edu/libarts/polsci/Statistics.html>
 - http://www.stattools.net/ICC_Exp.php
 - <http://www.sisu.edu/faculty/gerstman/StatPrimer/correlation.pdf>
- Page 95: Fagenbaum and Darling measured knee angles at different time points than this thesis, and compared between genders instead of heights, which can account for differences.
 - Fagenbaum and Darling did not report significant effects on vertical height or more extended knees at higher heights (i.e., “Similar jump landing knee kinematics were observed

... from the 25.4 and 50.8 cm high platforms). This needs to be revised, as well as the interpretation.

- Yeow (2010) calculated all measures at maximum knee flexion angle, which was before the time point in this thesis, therefore comparison is different (knee flexion was approx half at VGRFmax)
 - Contrary to the thesis, Yeow et al. (2010) reported "a significant elevation in knee flexion angles were noted at peak GRF and at maximum knee flexion". This needs to be revised, as well as the interpretation.
- Data on hip angles during landing are available and these can be used to compare with your results. Search "hip angle single leg landing" to find these papers
- Page 106, only one paper was mentioned to corroborate the shape of the VGRF curve, but this result is common to all single leg landing papers.
- A lack of comparative data on horizontal landings was mentioned but single leg hop studies various studies could be compared with your results, although they tend to have a longer horizontal distance, and therefore larger GRF
- The ankle angle results are more difficult to interpret since you measured at the largest VGRF, which is when the attenuation at the ankle would have been predominately over (max ankle angle 15-35 deg and the values you use are near neutral)
- Page 107: The interpretation of the ankle angle and dissipation may be interpreted differently than proposed. Since you are looking at the ankle angle at maximum VGRF, more plantar flexion may mean that less attenuation is required at the smaller distances (ankle is more plantarflexed at 30 cm and less as distance increases), so the ankle is more plantarflexed at the VGRFmax point. The terms "higher angle flexion angle" and "higher knee flexion angle" may confuse the issue since the reported ankle angles decrease over horizontal distance. In your study, smaller angles are related to more work.
 - You have correlations but non-significant differences for work, power, etc. Therefore, you should revise the statements based on correlations since more work was not achieved, in a statistical sense.
 - Two items can be correlated (i.e., similar shape of the curves) but the item with insufficient change between conditions (small difference in means) would still be insufficient
- Page 107: why would the use of repeated measures ANOVA contribute to your significant main effects?
- Page 108: remove the sentence on muscle firing patterns since the study does not support this statement with data.
- In the conclusions, state that the outcomes are consistent with the literature.

Paper 4

- Abstract: be more specific in the use of "biomechanics" to describe the variables or differences (use movement or "kinematics and kinetics", etc.). Biomechanical differences could also include muscle activation or other measures, which were not covered in this paper.
- The term "energetics" is used, but most of the analysis does not focus on energy, but forces. Kinetics is a better term for this paper

- Subjects: The average Canadian female is 69.4 kg and 161 cm (males are 82.7 kg and 174 cm). Your sample has relatively tall and slim women ... does this help to explain the lack of differences?
- Page 190: In the methods you used a 3-way MANOVA but you now state that "separate ANOVAs" were used and are reported in Table 1?
- Page 120: A table of mean and SD results is needed when discussing significant differences, reference to figures is not sufficient for the reader to understand the results
 - When talking about ankle angle, indicate dorsi or plantarflexion
 - From figure 2a and b, it look as if females were more plantarflexed than males, not smaller angles
 - Why pool the data when the paper is about gender differences?
 - You need to edit the Table 1 caption to indicate which data set is being analyzed (gender or pooled)
 - In table 1, "Distance x gender" and "Height x Distance x gender" do not show any significant outcomes, why are they included?
- Page 122: why do you only have 2 numbers for marginal means?
 - If you are talking about the marginal means at each height, why do you have 2 numbers?
 - How did you calculate the "difference in marginal means"?
- The analysis on page 122 and 123 is inappropriate since the values are plotted in figure 3, means of the VGRF at each horizontal distance are mentioned and then assumptions are made. I am assuming that this analysis is on the pooled data, but this should be specified. Preferably, a post hoc statistical test would be used to determine which measures are significantly different and a table of means and standard deviations would be provided for the reader. This section can then be revised to discuss the outcomes more effectively, referring to the table when necessary.
- Page 123: how can d1 and d2 both have the largest difference? In the next sentence, you say that h3 had the largest difference?
- Page 124: It is not evident from figure 5 since the curves are all different.
- Page 125: On figure 6, it looks as if the males have the higher trunk angles
- Table 3 is for the pooled data, you need a table with the male and female results separated
- I took the table 3 data and calculated correlations for VGRF and ankle angle (-0.20798) and VGRF and hip angle (0.10257). While these are expected to be different than running the correlation on data from each individual, these values are much lower than Table 4 and would likely not be significant. This changes the discussion. Please review your calculations.
 - Also, table 2 results showed correlation differences for males and females, which should be discussed
- Page 128: you state that females landed less plantarflexed; however, you did not report ankle angle at landing (only at max VGRF). Statement should be revised.
 - Were females more plantarflexed?
- The correlation discussion may be incorrect since the total range of ankle plantarflexion was not evaluated, just the angle at VGRFmax, which could be at least half the total range.

- In the discussion, state the hypotheses again so that the reader does not have to go back in the text to search for this, and this does become a problem since multiple hypotheses were not separated out in the introduction
- Page 129: you cannot support the statement about the importance of distance without the post-hoc statistics
 - Based on the methods, you cannot calculate how much attenuation occurred at each height x distance, you only know that people flex more as the task becomes more challenging (i.e., we do not know if the VGRF should have been x at d30h40, but it was really $<x$). So you cannot make statements about attenuation.
 - The statement about higher hip flexion angle and lower peak VGRF is not as simple to discuss since you did not have a significant height effect, just distance. Therefore, your statement would not apply to vertical drop landings.
 - You state that table 4 involves the main effects of height x distance, but ankle angle was not significant, as shown in Table 1.
- Page 130: the statement that you cannot compare results with the literature is incorrect. A table to results or ranges of results could be used as comparators
 - How would repeated measures ANOVA increase the chance of significant findings?
 - For gender analysis $n=6$
 - Did the Power analysis not provide information on energy absorption? Investigating what contributed to energy absorption is not a limitation but another line of research
 - Since no significant difference in GRF was found between genders, you cannot say that the ability to attenuate GRF was compromised or that the females were at increased risk
- Page 131: the statement on significant associations was only for the pooled data, which is not clear from the statement
 - The statement that the study suggests that factors other than biomechanical are more involved cannot be made since the people were not in an injury situation. If they had an ACL injury, you may see biomechanical factors. Your study shows that matched males and females can accomplish the set tasks similarly.
- In the discussion, only one paragraph talk about gender differences, the text should be revised to make sure that the reader understands when pooled data is being discussed.
- This is predominately a paper on pooled data with a similar analysis to Paper 3, but with more subjects. If this pooling is appropriate, then why not do this for Paper 3 and remove the analysis from Paper 4? You would have a larger n

Paper 5

- Page 136: Since you showed in paper 4 that gender was not a factor for the tasks, how can you use this data to provide an understanding of gender differences?
- Page 137: It is difficult to make a statement that "level of effort" is the reason MSM are not used since the main issue is likely that we have not created a reliable MSM that can be applied across people that differ from normal

- Page 139: You need to build on Paper 4 for the hypotheses, etc. for this paper 5. Therefore, you already know that there was only 1 gender-based difference (ankle angle) so you cannot continue to assume that the 2 groups are different for “lower extremity kinematics” , “VGRF”, etc.
 - Since you know that the input data are similar, how can you hypothesize that the model would provide significantly different reaction and muscle forces?
- Page 140: Why is the subject selection for Paper 5 a poorer match than Paper 4?
- Page 142: Remove value statements about how “time consuming” research can be. Better to just say what you did.
- Page 143: You need to say how you calculated experimental kinematics.
- Be clearer as to what was done by AnyBody and what was done externally using another method
- Page 144: Please separate methods and results
 - What EMG data is being presented? How many subjects? ...
 - The actual EMG occurred before the modelled EMG. You state that this was expected since the model does not include latency due to muscle response to a stimulus. However, this would result in the muscle model EMG occurring before the measured EMG (i.e., since the muscle model would not have this latency). Please revise this thought
 - Why use a correlation to test the difference? The difference in values are more relevant for timing (i.e., comparing onset and duration values, means, etc.).
 - Please provide a table of the onset and duration for EMG for comparison (mean and SD). The difference in Figure 2 are rather large, how can you consider this valid?
 - Why not test from foot contact to double support?
 - Based on validation 1 that was presented, I would consider that the model was not valid!
- Page 146: For validation 2, you found discrepancies that could provide a 25% error in Fz, your main outcome measure but did not correct this in the model. This does not support validity for the model.
 - Also, how would declining to revise the model make it more reproducible?
- Revise all papers to show that you are presenting takeoff and landing, not just landing
- Section 2.3: You did not prove validity in the previous section
 - EMG and other such methods can be moved to 2.1
 - Statistical comparisons for gender should be removed with an $n=3$ ($n-1=2$). Just use descriptive statistics
 - Figures 5 and 6 have many lines per graph. You can keep this in the document since it does show general shape of the curves, but you should not use this as a source when discussing differences
 - Why are the joint angles in table 3 so different that the angles in Paper 4, Table 4?
 - VGRF results show that these groups are different than Paper 4, so the subject matching may not be appropriate
 - Page 153, while all ANOVA statistics should be removed, the statement that the largest differences must be significant cannot be made. You need to perform a post-hoc test on the results. Since $n-1$ would be only 2 this is inadvisable.
 - Are the correlations performed on pooled data? If you have shown differences in gender, then how can you validly pool the data?

- What is correlated? All data for all conditions for all subjects?
 - Figure 7: replace with a 2D graph to make it easier for the reader to compare males and females
- Page 156: you did not show reasonable agreement, and no definition of reasonable agreement was provided and supported
- Section 4: As with section 2,3, the statistical analysis should be removed
 - No hamstring/quadriceps ratio reported in results
 - Axial compressive force is higher since VGRF is higher
 - Page 158: Given the MSM, if the relationship between the PTASF and quadriceps force expected
 - You have shown that a greater external force on the body (VGRF) makes a MSM calculate greater forces at the knee and for the muscles around the knee (quads and hamstrings). This does not show that hamstring muscles reduce VGRF
 - Since you only examined forces at VGRFmax, you cannot make statements about ACL strain over the entire range of knee flexion
 - Since you seem to have combined all measures, was the correlation really due to change in horizontal distance (i.e., a different task) instead of a modulation of PTASF strategy. Correlation does not mean that the 2 variables are related, just that they vary similarly. The cause could be another factor.
 - Main limitation is that no injury occurred, so you are not really looking at ACL injury based on the input data.
- Please see paper: A Finite Element Analysis of a Subject Specific Single-Leg Drop Landing at Varied Heights, CY Tse, H Nayeb-Hashemi, A Vaziri, PK Canavan – 2011
- You only have one model, with different inputs (marker data for limb dimensions is also an input)

Summary

- Page 165: This is a good place to explain why you did not follow the recommendations in the review papers for the thesis research
 - The sentence starting with “Stemming from” is not supported by the review articles (i.e., the review did not support research on non-injury single leg landings)
 - Please see edits in paper version of the thesis, most of the concerns are addressed previously in this document

Christine Bourbonnais-Hendley

From: Michel Labrosse
Sent: Monday, September 24, 2012 3:33 PM
To: Christine Bourbonnais-Hendley
Subject: RE: Evaluation of the revised thesis of Mr. Nicholas Ali

Hello Christine,

Thank you, I filled out the form and put it in the intra mail. Please note that I checked Box 1: the thesis is accepted for the defense, but I did not provide comments in Section B. This is because the evaluation of this thesis makes me uncomfortable. I was invited to be a member of the advisory committee at a time when the applicant was planning to do things in my area of expertise, but this later turned out to be impractical. So, whatever he did is outside of my area, and my comments may not be very pertinent.

Best regards,
Michel Labrosse

From: Christine Bourbonnais-Hendley [mailto:cbourbon@uottawa.ca]
Sent: September 20, 2012 3:38 PM
To: labrosse@genie.uottawa.ca
Subject: Evaluation of the revised thesis of Mr. Nicholas Ali

Good afternoon,

- You have evaluated the revised thesis of Mr. Nicholas Ali in August-September 2012. It has come to our attention that the evaluation report provided to you by our office was not for a revised thesis. Could you please complete and sign the form available on our website at: [Thesis examiner's report for revised thesis](#) and return it to us (by email) at your earliest convenience? If you have any questions please do not hesitate to contact us.

Regards,

Christine B. Hendley
Administratrice des thèses et de la diplômation /
Thesis and Graduation Office Administrator
Faculté des études supérieures et postdoctorales /
Faculty of Graduate and Postdoctoral Studies
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cbourbon@uottawa.ca



THESIS EXAMINER'S REPORT FOR A
REVISED THESIS

Version française : Rapport d'évaluation pour
une thèse *remaniée*

NAME OF STUDENT NICHOLAS ALI	STUDENT NUMBER	DOCTORAL THESIS ☒	MASTER'S THESIS ☐
DEGREE PhD		ACADEMIC UNIT School of Human Kinetics	
TITLE OF THESIS Predicting risk factors of non-contact ACL injuries during single-leg landing			
NAME OF THESIS SUPERVISOR GORDON ROBERTSON		NAME OF THESIS CO-SUPERVISOR GHOLAMREZA ROUHI	
NAME OF EXAMINER MICHEL LABROSSE		DEADLINE FOR SUBMISSION OF REPORT	

INSTRUCTIONS FOR EXAMINERS

- PART A: EVALUATION / Tick off the choice that best describes your evaluation of the revised thesis.
 PART B: COMMENTS / Provide your comments for each of the topics listed.
 PART C: RECOMMENDATION FOR A PRIZE / Indicate your decision and complete the attached form if recommending thesis for a prize.
 PART D: SIGNATURE / Sign and date the form
 PART E: DOCUMENTS / Return necessary documents.

PART A: EVALUATION

CRITERIA

DOCTORAL THESIS: THE THESIS must constitute a significant contribution to knowledge, embody the results of original investigation and analysis by the student and be of such quality as to merit publication.

MASTER'S THESIS: THE THESIS should demonstrate that the candidate is able to work in a scholarly manner and is acquainted with the principal works published on the subject of the thesis. Insofar as it is possible, the thesis should be an original contribution.

VERDICT

- | | | |
|---|-------------------------------------|---|
| 1 | ☒ | <p>The revised thesis is <u>accepted</u> for the defence.</p> <ul style="list-style-type: none"> The revised thesis meets the evaluation criteria listed above. Required changes are limited to correcting occasional grammatical or spelling errors, formatting problems or to minor redundancies or omissions (e.g., transitional paragraphs, notes). |
| 2 | ☐ | <p>The revised thesis is <u>accepted</u> for the defence but <u>additional changes</u> are required <u>AFTER DEFENCE</u>.</p> <ul style="list-style-type: none"> The quality of the presentation is acceptable and the necessary changes will not have an impact on the defence. During the defence, the jury will determine which additional changes are necessary and who will be responsible for ensuring they have been completed and for approving the thesis. |
| 3 | ☐ | <p>The revised thesis <u>still cannot be accepted</u> for the defence and must undergo additional extensive revision <u>BEFORE DEFENCE</u> to ensure it meets the above criteria.</p> <ul style="list-style-type: none"> There are still problems with the interpretation of results or the theoretical or methodological approach, but the thesis may meet the criteria if substantial changes are made. The presentation of the revised thesis is still not acceptable (numerous grammatical or spelling errors, evidence of carelessness, etc.). <p>In this case, the revised thesis is returned to the candidate to complete additional revisions, corrections and changes. The candidate must submit a new revised version of the thesis to the examiners. The examiners must judge the changes satisfactory before the thesis can proceed to the defence stage.</p> <p>If more than one examiner chooses this verdict for the revised thesis, the student must withdraw from the program.</p> |
| 4 | ☐ | <p>The revised thesis <u>still fails to meet the standards required</u> for the degree.</p> <ul style="list-style-type: none"> The work was not done in accordance with established methodology employed in the discipline. The thesis still does not exhibit the candidate's capacity to meet the scholarly standards required. Even with additional extensive revision, the thesis would not meet the standards required for the degree. <p>By choosing this verdict, the examiner recommends the student withdraw from the program. If more than one examiner chooses this verdict for the revised thesis, the student must withdraw from the program.</p> |

NOTE: Your feedback will have an impact on how the candidate prepares for the defence, the dean's decision if the jury is divided and the awarding of prizes. Please be sure to complete Section B regardless of your verdict.

PART B: COMMENTS

Please provide your comments on each of the topics below in a separate document. If the thesis is accepted for the defence (see verdicts # 1 and # 2, above), your comments will be sent to the candidate and the thesis supervisor without reference to your identity. If major revisions are required before the defence (see verdict # 3, above), a signed copy of your comments will be provided to the student, the supervisor, as well as to all members of the jury and the chair of the academic unit.

- UNDERSTANDING OF THE SUBJECT MATTER
- CONTRIBUTION OF THE THESIS TO ADVANCING KNOWLEDGE
- RESEARCH METHODOLOGY
- ANALYSIS OF RESULTS AND VALUE OF CONCLUSIONS
- ORGANIZATION, WRITING STYLE AND PRESENTATION OF MATERIAL
- REVISIONS CONSIDERED NECESSARY IN ORDER FOR THESIS TO BE ACCEPTED
- GENERAL COMMENTS

Your comments and explanations are extremely important and will:

- help the student prepare for the defence or make necessary revisions to the thesis (if revisions are required before the defence, a signed copy of your comments is provided to the candidate, the thesis supervisor, as well as to all members of the jury and the chair of the academic unit);
- allow the dean of FGPS to make an informed decision if the jury is divided; and
- allow the FGPS selection committee to choose recipients of prizes and medals.

PART C: RECOMMENDATION FOR A PRIZE

DO YOU RECOMMEND THIS THESIS FOR A PRIZE?

- (☐) YES – Please complete the attached NOMINATION FOR THESIS PRIZE form.
(☒) NO

The absence of a reply will be considered a NO.

PART D: SIGNATURE

DATE Sept. 24, 2012 SIGNATURE Richard Lalonde

PART E: DOCUMENTS

DOCTORAL THESIS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed self-addressed envelope to:

Thesis Sector
FGPS
Hagen Hall
115 Séraphin-Marion, Room 107
Ottawa ON K1N 6N5

MASTER'S THESIS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed envelope to your academic unit.



THESIS EXAMINER'S REPORT

NAME OF STUDENT Nicholas Ali	STUDENT NUMBER 5033260	DOCTORAL THESIS ☒	MASTER'S THESIS ☐
DEGREE Ph. D.		ACADEMIC UNIT School of Human Kinetics	
TITLE OF THESIS "Predicting Risk Factors of Non-Contact Anterior Cruciate Ligament Injuries During Single-Leg Landing"			
NAME OF THESIS SUPERVISOR Dr. Gordon Robertson		NAME OF THESIS CO-SUPERVISOR Dr. Gholamreza Rouhi	
NAME OF EXAMINER Dr. Michel Labrosse		DEADLINE FOR SUBMISSION OF REPORT Friday, September 7 2012	
INSTRUCTIONS FOR EXAMINERS			
PART A: EVALUATION / Tick off the choice that best describes your evaluation of the thesis. PART B: COMMENTS / Provide your comments for each of the topics listed. PART C: RECOMMENDATION FOR A PRIZE / Indicate your decision and complete the attached form if recommending thesis for a prize. PART D: SIGNATURE / Sign and date the form PART E: DOCUMENTS / Return necessary documents.			
PART A: EVALUATION			
CRITERIA			
DOCTORAL THESIS: The thesis must constitute a significant contribution to knowledge, embody the results of original investigation and analysis by the student and be of such quality as to merit publication. MASTER'S THESIS: The thesis should demonstrate that the candidate is able to work in a scholarly manner and is acquainted with the principal works published on the subject of the thesis. Insofar as it is possible, the thesis should be an original contribution.			
VERDICT			
1	☒	The thesis is accepted for the defence. - The thesis meets the evaluation criteria listed above. - Required changes are limited to correcting occasional grammatical or spelling errors, formatting problems or to minor redundancies or omissions (e.g., transitional paragraphs, notes).	
2	☐	The thesis is accepted for the defence but must be revised <u>AFTER DEFENCE</u>. - The quality of the presentation is acceptable and the necessary revisions will not have an impact on the defence. - During the defence, the jury will determine which revisions are necessary and who will be responsible for ensuring they have been completed and for approving the thesis.	
3	☐	The thesis cannot be accepted for the defence and must undergo extensive revision <u>BEFORE DEFENCE</u> to ensure it meets the above criteria. - There are problems with the interpretation of results or the theoretical or methodological approach, but the thesis may meet the criteria if substantial changes are made. - The presentation of the thesis is still not acceptable (numerous grammatical or spelling errors, evidence of carelessness, etc.). In this case, the thesis is returned to the candidate to complete the required revisions, corrections and changes. The candidate must submit a revised version of the thesis to the examiners. The examiners must judge the changes satisfactory before the thesis can proceed to the defence stage.	
4	☐	The thesis still fails to meet the standards required for the degree. - The work was not done in accordance with established methodology employed by the discipline. - The thesis does not exhibit the candidate's capacity to meet the scholarly standards required. - Even with extensive revision, the thesis would not meet the standards required for the degree. In this case, the candidate may be asked to withdraw from the program.	
NOTE: Your feedback will have an impact on how the candidate prepares for the defence, the dean's decision if the jury is divided and the awarding of prizes. Please be sure to complete Section B <u>regardless</u> of your verdict.			

PART B: COMMENTS

Please provide your comments on each of the topics below in a separate document. If the thesis is accepted for the defence (see verdicts # 1 and # 2, above), your comments will be sent to the candidate and the thesis supervisor without reference to your identity. If major revisions are required before the defence (see verdict # 3, above), a signed copy of your comments will be provided to the student, the supervisor, as well as to all members of the jury and the chair of the academic unit.

- UNDERSTANDING OF THE SUBJECT MATTER
- CONTRIBUTION OF THE THESIS TO ADVANCING KNOWLEDGE
- RESEARCH METHODOLOGY
- ANALYSIS OF RESULTS AND VALUE OF CONCLUSIONS
- ORGANIZATION, WRITING STYLE AND PRESENTATION OF MATERIAL
- REVISIONS CONSIDERED NECESSARY IN ORDER FOR THESIS TO BE ACCEPTED
- GENERAL COMMENTS

Your comments and explanations are extremely important and will:

- help the student prepare for the defence or make necessary revisions to the thesis (if revisions are required before the defence, a signed copy of your comments is provided to the candidate, the thesis supervisor, as well as to all members of the jury and the chair of the academic unit);
- allow the dean of FGPS to make an informed decision if the jury is divided; and
- allow the FGPS selection committee to choose recipients of prizes and medals.

PART C: RECOMMENDATION FOR A PRIZE

Do you recommend this thesis for a prize?

- ☐ YES – Please complete the attached NOMINATION FOR THESIS PRIZE form.
- ☒ NO

The absence of a reply will be considered a NO.

PART D: SIGNATURE

DATE Aug 17, 2012 SIGNATURE Oricel Lebrun

PART E: DOCUMENTS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed self-addressed envelope to:

Thesis office
FGPS
Hagen Hall
115 Séraphin-Marion, Room 107
Ottawa ON K1N 6N5



uOttawa

Université d'Ottawa
Faculté des études supérieures
et postdoctorales

University of Ottawa
Faculty of Graduate and
Postdoctoral Studies

No comments provided

Christine Bourbonnais-Hendley

From: Graham Caldwell <gc@kin.umass.edu>
Sent: Monday, September 24, 2012 10:54 AM
To: Christine Bourbonnais-Hendley
Subject: Re: Evaluation of the revised thesis of Mr. Nicholas Ali

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Christine,

After carefully considering the new Thesis Report form for the REVISED Thesis, I will be choosing a Verdict of 2 (The revised thesis is accepted for the defence but additional changes are required AFTER DEFENCE) in Part A: Evaluation. The rest of my original evaluation form will remain the same.

I will fill in the form and send it to your office later today, but I suspect time is of the essence here so wanted to inform you of my decision as soon as possible.

Sincerely,
Graham

On 9/20/2012 3:38 PM, Christine Bourbonnais-Hendley wrote:

Good afternoon,

- You have evaluated the revised thesis of Mr. Nicholas Ali in August-September 2012. It has come to our attention that the evaluation report provided to you by our office was not for a revised thesis. Could you please complete and sign the form available on our website at: [Thesis examiner's report for revised thesis](#) and return it to us (by email) at your earliest convenience? If you have any questions please do not hesitate to contact us.

Regards,

Christine B. Hendley
Administratrice des thèses et de la diplômation /
Thesis and Graduation Office Administrator
Faculté des études supérieures et postdoctorales /
Faculty of Graduate and Postdoctoral Studies
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Graham E. Caldwell, Ph.D.
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Totman Building, Room 105
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e-mail: gc@kin.umass.edu
phone: 1-413-545-0017

THESIS EXAMINER'S REPORT FOR A
REVISED THESISVersion française : Rapport d'évaluation pour
une thèse remaniée

NAME OF STUDENT Nicholas Ali	STUDENT NUMBER 5033260	DOCTORAL THESIS ☒	MASTER'S THESIS ☐
DEGREE Ph.D	ACADEMIC UNIT School of Human Kinetics		
TITLE OF THESIS Predicting Risk Factors of Non-contact Anterior Cruciate Ligament Injuries <i>During Single-Leg Landings</i>			
NAME OF THESIS SUPERVISOR Dr. Gordon Robertson		NAME OF THESIS CO-SUPERVISOR Dr. Gholamreza Rouhi	
NAME OF EXAMINER Dr. Graham E. Caldwell		DEADLINE FOR SUBMISSION OF REPORT Friday, Sept. 7, 2012	
INSTRUCTIONS FOR EXAMINERS			
PART A: EVALUATION / Tick off the choice that best describes your evaluation of the revised thesis. PART B: COMMENTS / Provide your comments for each of the topics listed. PART C: RECOMMENDATION FOR A PRIZE / Indicate your decision and complete the attached form if recommending thesis for a prize. PART D: SIGNATURE / Sign and date the form PART E: DOCUMENTS / Return necessary documents.			
PART A: EVALUATION			
CRITERIA			
DOCTORAL THESIS: THE THESIS must constitute a significant contribution to knowledge, embody the results of original investigation and analysis by the student and be of such quality as to merit publication.			
MASTER'S THESIS: THE THESIS should demonstrate that the candidate is able to work in a scholarly manner and is acquainted with the principal works published on the subject of the thesis. Insofar as it is possible, the thesis should be an original contribution.			
VERDICT			
1	☐	The revised thesis <u>is accepted</u> for the defence. - The revised thesis meets the evaluation criteria listed above. - Required changes are limited to correcting occasional grammatical or spelling errors, formatting problems or to minor redundancies or omissions (e.g., transitional paragraphs, notes).	
2	☒	The revised thesis <u>is accepted</u> for the defence but additional changes are required <u>AFTER DEFENCE</u>. - The quality of the presentation is acceptable and the necessary changes will not have an impact on the defence. - During the defence, the jury will determine which additional changes are necessary and who will be responsible for ensuring they have been completed and for approving the thesis.	
3	☐	The revised thesis <u>still cannot be accepted</u> for the defence and must undergo additional extensive revision <u>BEFORE DEFENCE</u> to ensure it meets the above criteria. - There are still problems with the interpretation of results or the theoretical or methodological approach, but the thesis may meet the criteria if substantial changes are made. - The presentation of the revised thesis is still not acceptable (numerous grammatical or spelling errors, evidence of carelessness, etc.) In this case, the revised thesis is returned to the candidate to complete additional revisions, corrections and changes. The candidate must submit a new revised version of the thesis to the examiners. The examiners must judge the changes satisfactory before the thesis can proceed to the defence stage. If more than one examiner chooses this verdict for the revised thesis, the student must withdraw from the program.	
4	☐	The revised thesis <u>still fails to meet the standards required</u> for the degree. - The work was not done in accordance with established methodology employed in the discipline. - The thesis still does not exhibit the candidate's capacity to meet the scholarly standards required. - Even with additional extensive revision, the thesis would not meet the standards required for the degree. By choosing this verdict, the examiner recommends the student withdraw from the program. If more than one examiner chooses this verdict for the revised thesis, the student must withdraw from the program.	
NOTE: Your feedback will have an impact on how the candidate prepares for the defence, the dean's decision if the jury is divided and the awarding of prizes. Please be sure to complete Section B <u>regardless</u> of your verdict.			

PART B: COMMENTS

Please provide your comments on each of the topics below in a separate document. If the thesis is accepted for the defence (see verdicts # 1 and # 2, above), your comments will be sent to the candidate and the thesis supervisor without reference to your identity. If major revisions are required before the defence (see verdict # 3, above), a signed copy of your comments will be provided to the student, the supervisor, as well as to all members of the jury and the chair of the academic unit.

- UNDERSTANDING OF THE SUBJECT MATTER
- CONTRIBUTION OF THE THESIS TO ADVANCING KNOWLEDGE
- RESEARCH METHODOLOGY
- ANALYSIS OF RESULTS AND VALUE OF CONCLUSIONS
- ORGANIZATION, WRITING STYLE AND PRESENTATION OF MATERIAL
- REVISIONS CONSIDERED NECESSARY IN ORDER FOR THESIS TO BE ACCEPTED
- GENERAL COMMENTS

Your comments and explanations are extremely important and will:

- help the student prepare for the defence or make necessary revisions to the thesis (if revisions are required before the defence, a signed copy of your comments is provided to the candidate, the thesis supervisor, as well as to all members of the jury and the chair of the academic unit);
- allow the dean of FGPS to make an informed decision if the jury is divided; and
- allow the FGPS selection committee to choose recipients of prizes and medals.

PART C: RECOMMENDATION FOR A PRIZE

DO YOU RECOMMEND THIS THESIS FOR A PRIZE?

() YES – Please complete the attached NOMINATION FOR THESIS PRIZE form.

(☒) NO

The absence of a reply will be considered a NO.

PART D: SIGNATURE

DATE Sept. 24, 2012 SIGNATURE Graham Caldwell

PART E: DOCUMENTS

DOCTORAL THESIS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed self-addressed envelope to:

Thesis Sector
FGPS
Hagen Hall
115 Séraphin-Marion, Room 107
Ottawa ON K1N 6N5

MASTER'S THESIS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed envelope to your academic unit.



THESIS EXAMINER'S REPORT

NAME OF STUDENT Nicholas Ali		STUDENT NUMBER 5033260	DOCTORAL THESIS ☒	MASTER'S THESIS ☐
DEGREE Ph. D.		ACADEMIC UNIT School of Human Kinetics		
TITLE OF THESIS "Predicting Risk Factors of Non-Contact Anterior Cruciate Ligament Injuries During Single-Leg Landing"				
NAME OF THESIS SUPERVISOR Dr. Gordon Robertson		NAME OF THESIS CO-SUPERVISOR Dr. Gholamreza Rouhi		
NAME OF EXAMINER Dr. Graham E. Caldwell		DEADLINE FOR SUBMISSION OF REPORT Friday, September 7 2012		
INSTRUCTIONS FOR EXAMINERS				
PART A: EVALUATION / Tick off the choice that best describes your evaluation of the thesis. PART B: COMMENTS / Provide your comments for each of the topics listed. PART C: RECOMMENDATION FOR A PRIZE / Indicate your decision and complete the attached form if recommending thesis for a prize. PART D: SIGNATURE / Sign and date the form PART E: DOCUMENTS / Return necessary documents.				
PART A: EVALUATION				
CRITERIA				
DOCTORAL THESIS: The thesis must constitute a significant contribution to knowledge, embody the results of original investigation and analysis by the student and be of such quality as to merit publication. MASTER'S THESIS: The thesis should demonstrate that the candidate is able to work in a scholarly manner and is acquainted with the principal works published on the subject of the thesis. Insofar as it is possible, the thesis should be an original contribution.				
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3	☒	The thesis cannot be accepted for the defence and must undergo extensive revision <u>BEFORE DEFENCE</u> to ensure it meets the above criteria. - There are problems with the interpretation of results or the theoretical or methodological approach, but the thesis may meet the criteria if substantial changes are made. - The presentation of the thesis is still not acceptable (numerous grammatical or spelling errors, evidence of carelessness, etc.). In this case, the thesis is returned to the candidate to complete the required revisions, corrections and changes. The candidate must submit a revised version of the thesis to the examiners. The examiners must judge the changes satisfactory before the thesis can proceed to the defence stage.		
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PART B: COMMENTS

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- UNDERSTANDING OF THE SUBJECT MATTER
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Your comments and explanations are extremely important and will:

- help the student prepare for the defence or make necessary revisions to the thesis (if revisions are required before the defence, a signed copy of your comments is provided to the candidate, the thesis supervisor, as well as to all members of the jury and the chair of the academic unit);
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PART C: RECOMMENDATION FOR A PRIZE

Do you recommend this thesis for a prize?

☐ YES – Please complete the attached NOMINATION FOR THESIS PRIZE form.

☒ NO

The absence of a reply will be considered a NO.

PART D: SIGNATURE

DATE

Sept 10, 2012

SIGNATURE

Graham Caldwell

PART E: DOCUMENTS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed self-addressed envelope to:

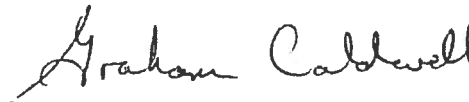
Thesis office
FGPS
Hagen Hall
115 Séraphin-Marion, Room 107
Ottawa ON K1N 6N5

Doctoral Thesis External Examiner Report

September, 2012

Candidate: Nicholas Ali
University of Ottawa

Examiner: Graham E. Caldwell, Ph.D.
University of Massachusetts Amherst



Title: Predicting risk factors of non-contact anterior cruciate ligament injuries during single-leg landing

Examiner's Report

General comments: In this 2nd iteration of the thesis, the candidate addresses the concerns of the committee from the initial evaluation (December, 2011). The main focus and structure of the thesis remains the same, in that he examines single-leg landings from various vertical height and horizontal distance combinations, and attempts to relate kinematic and kinetic variables from these landings to anterior cruciate ligament (ACL) loading and injury risk. The candidate presents his work in a series of 5 papers (Chapters 2 to 6), with Chapter 1 serving as an overall Introduction and Chapter 7 being re-titled as Summary and Future Studies, rather than its original designation as an overall Discussion. Papers 1 and 2 are reviews of the current literature concerning ACL biomechanics and injury, papers 3 and 4 describe the experimental studies that used a rigid body inverse dynamics approach to investigate the single-leg landings, and paper 5 describes the development and use of a musculoskeletal model (MSM) for estimating internal forces that cannot be measured or computed with the rigid body approach.

The revised version has addressed some of my initial concerns, most notably with the inclusion of a detailed description of knee anatomy and function in Chapter 1, more complete reporting of results in papers 3 and 4, and a re-interpretation of some previously misunderstood correlation results. In some cases the candidate addressed my concerns in his response Comments sheet, but chose to make no changes to the thesis document (e.g. the rationale behind the objective function used to predict muscle forces in paper 5). In other cases the candidate apparently disagrees with my assessment (e.g. the use of single variables values occurring only at the time of peak VGRF versus computing how these variables change over the landing period, such as ankle or knee angle)

In my opinion there remain substantial issues with the thesis. In the following comments, the [Comment numbers] refer to the listed number from the PhD Thesis Review Sheet for Examiner B that was included with the revised thesis document.

- **Overstatement concerning novelty of optimization techniques such as simulated annealing** - [Comment 3] It appears from the author's response that he is aware that simulated annealing is commonly used optimization technique in the

biomechanics literature, and has been for over 10 years. However, the tone and vagueness of the author's writing implies that these optimization methods are new "AI" techniques that are at the heart of a new, integrated study approach that is better than those presently used in biomechanics research. From the author's responses to this and many other concerns, it is clear that he considers the issue to be that his work is "*focused on the domain of ACL injury biomechanics and NOT the entire field of biomechanics*". I disagree, and consider his work to be an application within the field of biomechanics. It is incorrect to portray simulated annealing as a novel technique because it has not been applied to this particular application when in fact it has been used within the field of biomechanics for many years.

- ***Inconsistency between "gap" study described in papers 1 and 2 with subsequent experimental papers 3, 4, 5 – [Comment 4]*** A main point of both papers 1 and 2 is that ACL injuries are multi-faceted, and current approaches that try to elucidate the role of a single risk factor are inadequate. Yet, papers 3 and 4 use the typical biomechanics approach that the author so heavily criticizes in papers 1 and 2. Even in paper 5 where the author describes a MSM, it is used to further analyze a subset of the same experimental data reported in paper 4, and not in the manner described in papers 1 and 2. In Chapter 1, section 1.13 is titled "Role of AI in this research"; this is misleading because I do not believe that such AI techniques were used in the research described in papers 3, 4 and 5.
- ***Lack of lateral and medial jump directions in papers 3, 4, 5 – [Comment 5]*** In his response, the author explains that some lateral jump data were collected but not included in papers 3 and 4. This should be mentioned in the Methods and/or Discussion in one or both of these papers, along with the reason(s) for their exclusion.
- ***Single value data at time of peak VGRF – [Comment 5]*** Papers 3, 4 and 5 now include time series kinematic and kinetic data that describe the time-varying changes that occur as subjects prepare and execute their landing. However, the author continues to base his analysis on single values taken from these time series at the time of peak VGRF, except for peak PGRF and knee joint work. It is inappropriate to use the single value of a variable at the time of VGRF to represent joint motion during entire execution of the landing, a fact that is now readily apparent from the time series data included in paper 3 on pages 102 to 104 (Figures 5 and 6).

For example, the ankle flexion values in Table 1 (0.22, -2.11, -2.67 degrees; page 98) and Table 3 (-7.97, -6.57, -5.02 degrees; page 100) observed at the time of peak VGRF do NOT indicate the degree of ankle flexion that occurs prior to and during the landing phase as seen in Figure 5a on page 102. These single value data form the basis for correlations with peak VGRF and peak PGRF (Tables 2 and 4), and the correlations are then interpreted with statements such as (page 106) "*For the vertical height tests we found ankle flexion angle was significantly correlated to peak VGRF*" (Table 2) and this implies that ankle flexion may be effective for attenuating peak VGRFs at increased vertical height of landing." While the

correlation may have been significant, the 2nd part of the sentence is incorrect, as the author has **not** assessed the amount of ankle flexion in each landing, only the ankle flexion angle that occurred at peak VGRF. From Figure 5a we see that perhaps the amount of ankle flexion does change with increasing vertical landing height, but to capture the amount of ankle flexion that occurs one needs to compute *the range of motion* that the ankle goes through during the period of interest. In fact, the ankle angle at the time of VGRF occurs during a time of rapid ankle angle change as represented by the steep slope of the curves in Figure 5a. This makes the assessment at that particular time sensitive to errors in the exact time of VGRF determination (one data frame on either side of the true peak will have very different ankle angle values), and to data reduction choices such as smoothing frequency cut-offs. Perhaps this sensitivity explains why the ankle angles in Table 3 (Horizontal Distance Test, all done from 40 cm height) are so different from the 40 cm height value in Table 1 (Vertical Distance Test).

Clearly, the ankle angle at the time of peak VGRF does not represent the ankle flexion that occurred during the landing, and this criticism extends to all variables that were analyzed in this manner. This "single value at time of peak GRF" analysis is repeated in papers 4 and 5, and can lead to incorrect conclusions on any variable assessed in this manner, making the interpretation of correlations using these single values and the related discussion in papers 3, 4 and 5 suspect, if not meaningless.

- **Subject population(s) in papers 3, 4, 5 – [Comment 8]** In my previous review I asked about the subject populations in papers 3, 4 and 5, and learned that indeed there was overlap between the papers. In the revised thesis document there are nine male subjects in paper 3, with the same data from six of these males being reported again in paper 4 to compare with six female subjects. In paper 5, there are three male and three female subjects, who are a subset of the subjects in paper 4. In response to my query, the student included the comment "*Be aware please, however, this is an article style thesis and these manuscripts are very separate papers with different objectives, hypothesis and methods.*" This is completely irrelevant, and the fact that they are three separate papers makes it even more important that the readers be made aware that some of the data has been previously reported. It is imperative in paper 5 that the subject description (page 140) includes the disclosure that the data from these subjects was used and reported in an earlier paper (paper 4). Likewise in paper 4 (page 115) you should identify which six of the nine male subjects in paper 3 were included in paper 4.

Further, in paper 5 the use of a subset of the subjects (three males and three females) from paper 4 (six males, six females) has produced a serious problem. In paper 4 the only gender difference reported in Table 1 (page 120) was for ankle flexion angle ("*Females had significantly smaller ankle flexion angles than males*" – page 120). In paper 5 there is a gender difference reported for peak VGRF ("*females had significantly lower peak VGRF*" – page 151, data in Tables 3a and 3b). This paper 5 gender difference for VGRF was **not** seen in paper 4, and the paper 4 gender difference for ankle flexion in the 40 cm test was **not** seen in paper 5. Because there are the same subjects and data measurements, the only possible explanation is

that the subset of subjects selected for paper 5 was not representative of the complete paper 4 subject population. Presumably if the other three male and three female subjects had been chosen for paper 5, the gender difference would have been reversed, with females having significantly higher peak VGRF. This incongruence between the data in paper 4 and 5 leads to problems in the discussions of the papers, where in one paper your results agree with certain papers in the literature and in the other case your results disagreeing with those same papers. Indeed, paper 4 and paper 5 disagree with each other despite the use of the same subjects and data! This would presumably be solved by including all six male and six females from paper 4 in paper 5.

- **Description of MSM in paper 5 – [Comment 10]** In response to my criticism of the incomplete description of the MSM in paper 5, the author gave me more details of the model and included at least some of these details in the revised version of paper 5. Based on the text in the revised paper 5, the following issues with the MSM remain:

- **How was the MSM motion determined?** The first part of the modeling process was to fit the MSM model to the motion of the retro-reflective markers worn by the subject. This serves to scale the model to the subject and for pose estimation: find the model positions that best represent the subject movement at each point in time throughout the time of interest. The text describing this process is on pages 142-143. (Note that this process was also done in Visual 3D for the data in papers 3 and 4, but was not described.) In the MSM, was this done using a 6 DOF model for each body segment, or was an inverse kinematics model used in which the body segments are constrained in their motion by the model joint properties?
- **Confusing terminology:** On page 142, the second modeling process is described as “Inverse dynamics analysis was used to determine the unknown joint reaction and muscle forces from the known motion.” This is confusing because the term *inverse dynamics analysis* refers to a method of calculating the unknown joint reaction forces and joint moments that must be present to conform to Newton’s Laws for a linked-segment rigid body model, and was used as the basis for data analysis in papers 3 and 4. First introduced in the first half of the twentieth century, this method has been the most prominent analysis tool used in human body biomechanics research since the 1970s. The computed joint reaction forces and moments have limits in their interpretation due to assumptions regarding the absence of muscle forces in these rigid body models. I am sure the candidate is aware of this analysis technique, as he used it in papers 3 and 4. He is also aware of its limitations, as he further asserts on page 142 that “Classical IDA cannot calculate muscle forces and consequently cannot be used to quantify internal joint reaction forces”.

The author should not use the term “inverse dynamics” in reference to the MSM which computes muscle forces. Further, he should not use the

term “joint reaction” in reference to the outputs of the MSM, because the inclusion of the model muscle force estimates means that computed internal joint contact forces will be different than the joint reaction force calculated with the inverse dynamics analysis.

- **Muscle models:** The muscle models in the MSM are described on page 143 as “*simple muscle models that did not consider the force-length and force-velocity relationships, as well as the passive stiffness of the muscles as the Hill muscle model does.*” The Hill model has been used in MSM models since ~1980, and has been considered the standard model to use since at least the early 1980’s when Audu and Davy published a paper comparing the merits of several different models. Why did the author not use the Hill model? Certainly this choice will influence the computed muscle forces from the MSM.
- **Objective function for muscle force determination:** The muscle forces computed in a MSM will depend heavily on the choice of **objective function** (sometimes called a *cost function*) used to determine how the resultant joint moments are to be distributed to the redundant underlying internal structures. On page 142 the author states that “*the objective function was designed to minimize the maximum muscle activity.*” What is the rationale for this choice? In the author’s response to my question, he stated that this cost function will reduce fatigue, but I did not find that assertion in the document. Without the benefit of a described rationale, I am at a loss as to understand why such an objective function would be chosen. The reduction of fatigue might be important for an endurance event such as walking or long-distance running, but it hardly seems relevant to a single-leg landing task.
- **MSM not subject- and gender- specific:** One of the stated purposes of paper 5 was to “*determine gender differences with respect to joint reaction and muscle forces.*” (page 139). Yet the MSM was the same for the male and female subjects, apart from being scaled to the individual subject body size. With the known differences in male versus female anatomy such as pelvis width that can directly affect knee structure (e.g. Q angle), why did the author not use female specific and male-specific models? The choice to use the same model will likely mask some differences in predicted muscle forces between the genders. The absence of gender- and subject-specific muscle strength values will also limit the usefulness of the MSM.
- **Use of gait data in model “validation” – [Comment 11]** In paper 5, the author describes the use of gait data to help validate the model. The MSM was applied to a walking trial collected from the subjects at the time of the landing data collection, and used to calculate internal variables that were compared to studies in which ~~in vivo knee data were collected~~ (Table 1, page 146). However, even if the gait model results are comparable to these literature values, how do we know the

MSM will be valid in an impact situation with sudden deceleration such as in single-leg landing? One specific issue in that regard is the use of an objective function that was designed to minimize the maximum muscle activity, and according to the author, minimize fatigue. This may well be an appropriate cost function with which to predict muscle forces in walking, but it seems entirely inappropriate for single-leg landings. Therefore, even if the gait comparison looks good, I continue to be unconvinced that the model should be considered validated as the author states.

- **Sensitivity analysis – [Comment 11]** In my previous report I asked if the candidate had performed a sensitivity analysis to see which model parameters had the largest impact on the model results. The author's response was *"we did various things to acquire confidence in the model such as sensitivity studies, comparison of outputs with Visual 3D and muscle modeling studies. Again, given this is an article style thesis this information was not added to the thesis given it was deemed unworthy of publication."* I am not sure who decided it was unworthy of publication, but these are important results that can help the reader of the thesis determine how much faith to put in the model results. If they don't fit within the confines of the paper, they should be included in an Appendix.
- **Omission of knee ligaments (including ACL) in MSM – [Comment 12]** I continue to not understand why the MSM in paper 5 did NOT include the ACL, which of course is the main topic of the doctoral thesis. Again, why was the ACL (and the other 3 major knee ligaments) omitted from the MSM? The author's response was that *"The material properties, geometry, and constitutive law to model the four major ligaments of the knee joint is unknown or under research. The kinematics of the ACL during single-leg landing is also unknown in the scientific community."* With the title and topic of the thesis, wouldn't an effort to model the ACL path based on its origin, insertion and a series of via points (as the muscle paths are defined) be worthwhile? The author states that *"Almost all mathematical models developed to date for the knee use one-dimensional representation for the ligaments."* Thus there are some models in the literature that would serve as a starting place. It seems that at least a first approximation of ACL kinematics during single leg landings could have been made. For a thesis on ACL injuries, the omission of the ACL from the developed MSM is a major oversight.
- **Other issues from candidate's response document:**
 - **[Comment 19]** What does the candidate mean when he says that *"Kinematic data filtered at 6 Hz and force plate data at 25 Hz worked out well"* ?
 - **[Comments 7 & 28]** In these comments the student seemingly rejects the notion that Newton's Laws predict that landing impulse must increase with increases in vertical and horizontal jump distances. His arguments are agreeable but are based on the fact that the body is not a lumped mass but rather a multi-segmented system. However, he is incorrect if he thinks that

Newton's Laws somehow do not hold in this situation. The impulse - momentum law states that $Ft = \Delta mv$, and in this landing situation the GRF vector represents the force F applied for time t to the body mass m . This force therefore acts to change the body's COM velocity v . With increases in height and distance, the initial velocity of the COM upon landing will also increase. During the landing phase, this initial velocity must be reduced to zero for successful completion of the landing. Because Δmv will therefore increase with height and distance, so must the impulse Ft . What the landing athlete can do is change their body motion upon landing to change the shape of the resulting Force-time curve, but the area under the curve (impulse) will remain constant no matter what landing strategy they adopt. With proper landing technique the athlete can perhaps prevent the peak force from increasing over a small range of height or distance increases, but the athlete can do nothing to prevent the impulse from increasing. I hope that the student's comments reflect nothing more than confusion concerning impulse *versus* peak force changes as height and distance increase.

Understanding of the subject matter: The candidate seems to understand the subject matter, as the review papers 1 and 2 display good knowledge of the extant literature concerning ACL injury. He has also chosen an important topic to study.

Contribution of the thesis to advancing knowledge: Until the data issues in papers 3, 4 and 5 outlined in the **General Comments** are addressed, I am unsure how much this thesis contributes to advancing knowledge.

Research methodology: The motion capture, force measurement and EMG data collection techniques used by the author are well established in the biomechanics community, as are the use of rigid body inverse dynamics models and musculoskeletal models. As described in the **General Comments** section above, I have questions concerning the implementation of the musculoskeletal modeling and the selection of subjects in paper 5.

Analysis of results and value of conclusions: As described in the **General Comments** section above, I have concerns about the computation of metric values from the time series data in papers 3, 4, and 5. This makes it impossible to fully understand the results of the experiments, and therefore the value of the conclusions. In my opinion, there are incorrect interpretations of at least some of the data presented, leading to some incorrect conclusions.

Organization, writing style and presentation of material: The organization of the thesis is logical, beginning with an overview of the literature, moving to the experimental work. The writing style itself is fine, although I find it more verbose than other authors I have read previously. However, I criticized

Chapter 7 which was titled "Discussion" but in fact was a summary of the 5 papers given in serial form, followed by a section on possible future research. It was not a general discussion of the thesis findings, which would integrate the important aspects of the different papers in a manner not possible within the separate chapters themselves. I suggested that with its original content, Chapter 7 would be better titled as "Summary and Future Studies." The candidate chose to act on this suggestion by changing the title, rather than re-write the text of the chapter to include such an integrated discussion. So now there is a void: the lack of a general integrated discussion of how the findings of the papers relate to each other and the topic of ACL injuries. I am unsure whether the university and school require such a chapter or not.

Revisions considered necessary in order for thesis to be accepted: Please refer to the **General Comments** section above for issues that, in my assessment, should be addressed in some manner before the manuscript can be accepted. Comments on more specific issues are listed below.

Specific Comments

1. **Page 95** Why was the integration time for knee joint work set to be from 0.8 s before VGRF to 0.6 s after VGRF? Why not start when the GRF data indicated initial foot contact?
2. **Page 95** Why didn't you calculate ankle and hip power and work too? This would allow you to better assess how the athletes changed their landing strategy with changes in height and distance.
3. **Page 96** The time history figures should be presented first, before the metric data that was selected from specific points of these curves.
4. **Page 98** In Table 1, shouldn't the peak HGRF (PGRF?) be negative? See Figure 4.
5. **Page 99** Table 2 is very confusing. Only the r values for peak VGRF are given, although others are reported in the text. What do the brackets with * mean?
6. **Page 100** In Table 3, shouldn't the peak HGRF (PGRF?) be negative? See Figure 4.
7. **Page 101** Table 4 is very confusing. Only the r values for peak PGRF are given, although others are reported in the text. What do the brackets with * mean?
8. **Page 106** In the first paragraph you state that single-leg landing data should not be compared to double-leg data, yet that is exactly what you do on page 107 with the Devita and Skelly study.
9. **Page 105 - 108** Nowhere in the Discussion of paper 3 do you discuss the differences between vertical height and horizontal distance landing strategies, even though in your introduction you speculate that there may be important differences that could influence ACL injury related variables.
10. **Page 115** Why did you hypothesize that there would be a significant effect on kinematics, kinetics and knee kinematics? This is opposite your view in the

previous chapter, and on page 114 you argue that increasing peak PGRF should affect knee response, and peak PGRF clearly increased with horizontal distance in the previous chapter (Table 3, page 100).

11. Page 119 Why are the PGRF curves in Figure 1b so different than the PGRF curves in the previous paper (Figure 4, page 102)?

12. Page 120 You state that "*Females had significantly smaller ankle flexion angles than males (see Figures 2a and 2b).*" However, these figures show that the females had greater plantar flexion angles (negative) than the males at the time of peak VGRF, not smaller.

13. Page 126 The descriptive statistics should be presented before the stats tables that reports significant differences.

14. Page 127 The peak PGRF data values in Table 3 are too small compared to the data shown in Figure 1b (page 119) or reported in the previous paper (Table 1, page 98).

15. Page 128 The text concerning females landing with less plantar flexed ankles is wrong (see comment **12. Page 120** and Figures 2a and 2b).

16. Page 130 The statement near the bottom of the page that "Females plantar flexed less..." is incorrect (see comments **12. Page 120**, **15. Page 128**, and Figures 2a and 2b).

17. Page 139 Why did you hypothesize that females will land with relatively greater peak VGRFs compared to males? You did not find gender differences in peak VGRF in paper 4, and these are a subset of those same data.

18. Page 150 In Figure 5, why is the x axis from 60 to 100 in normalized time? When did time 0 occur? When did time 100 occur? With the GRF data deviating from zero at ~90, it seems that most of the normalized time was well before landing.

19. Page 150 In Figure 5, why is the PGRF data positive?

20. Page 152 In Table 3, why are the ankle, knee and hip angles so different than in papers 3 and 4? Was a different angle convention used? If so, why?

Thesis examiner's report for a revised
thesis



NAME OF STUDENT Nicholas Ali		STUDENT NUMBER 5033260	DOCTORAL THESIS ☒	MASTER'S THESIS ☐
DEGREE Ph. D.		ACADEMIC UNIT School of Human Kinetics		
TITLE OF THESIS "Predicting Risk Factors of Non-Contact Anterior Cruciate Ligament Injuries During Single-Leg Landing"				
NAME OF THESIS SUPERVISOR Dr. Gordon Robertson		NAME OF THESIS CO-SUPERVISOR Dr. Gholamreza Rouhi		
NAME OF EXAMINER Dr. Michael Pierrynowski		DEADLINE FOR SUBMISSION OF REPORT Monday, November 19 2012		
INSTRUCTIONS FOR EXAMINERS				
PART A: EVALUATION / Tick off the choice that best describes your evaluation of the revised thesis. PART B: COMMENTS / Provide your comments for each of the topics listed. PART C: RECOMMENDATION FOR A PRIZE / Indicate your decision and complete the attached form if recommending thesis for a prize. PART D: SIGNATURE / Sign and date the form PART E: DOCUMENTS / Return necessary documents.				
PART A: EVALUATION				
CRITERIA				
DOCTORAL THESIS: The thesis must constitute a significant contribution to knowledge, embody the results of original investigation and analysis by the student and be of such quality as to merit publication. MASTER'S THESIS: The thesis should demonstrate that the candidate is able to work in a scholarly manner and is acquainted with the principal works published on the subject of the thesis. Insofar as it is possible, the thesis should be an original contribution.				
VERDICT				
1	☐	The revised thesis is accepted for the defence. - The revised thesis meets the evaluation criteria listed above. - Required changes are limited to correcting occasional grammatical or spelling errors, formatting problems or to minor redundancies or omissions (e.g., transitional paragraphs, notes).		
2	☐	The revised thesis is accepted for the defence but additional changes are required <u>AFTER DEFENCE</u>. - The quality of the presentation is acceptable and the necessary changes will not have an impact on the defence. - During the defence, the jury will determine which additional changes are necessary and who will be responsible for ensuring they have been completed and for approving the thesis.		
3	☒	The revised thesis still cannot be accepted for the defence and must undergo additional extensive revision <u>BEFORE DEFENCE</u> to ensure it meets the above criteria. - There are still problems with the interpretation of results or the theoretical or methodological approach, but the thesis may meet the criteria if substantial changes are made. - The presentation of the revised thesis is still not acceptable (numerous grammatical or spelling errors, evidence of carelessness, etc.). In this case, the revised thesis is returned to the candidate to complete additional revisions, corrections and changes. The candidate must submit a new revised version of the thesis to the examiners. The examiners must judge the changes satisfactory before the thesis can proceed to the defence stage. If more than one examiner chooses this verdict for the revised thesis, the student must withdraw from the program.		
4	☐	The revised thesis still fails to meet the standards required for the degree. - The work was not done in accordance with established methodology employed in the discipline. - The thesis still does not exhibit the candidate's capacity to meet the scholarly standards required. - Even with additional extensive revision, the thesis would not meet the standards required for the degree. By choosing this verdict, the examiner recommends the student withdraw from the program. If more than one examiner chooses this verdict for the revised thesis, the student must withdraw from the program.		

NOTE: Your feedback will have an impact on how the candidate prepares for the defence, the dean's decision if the jury is divided and the awarding of prizes. Please be sure to complete Section B regardless of your verdict.

PART B: COMMENTS

Please provide your comments on each of the topics below in a separate document. If the revised thesis is accepted for the defence (see verdicts # 1 and # 2, above), your comments will be sent to the candidate and the thesis supervisor without reference to your identity. If major revisions are required before the defence (see verdict # 3, above), a signed copy of your comments will be provided to the student, the supervisor, as well as to all members of the jury and the chair of the academic unit.

- UNDERSTANDING OF THE SUBJECT MATTER
- CONTRIBUTION OF THE THESIS TO ADVANCING KNOWLEDGE
- RESEARCH METHODOLOGY
- ANALYSIS OF RESULTS AND VALUE OF CONCLUSIONS
- ORGANIZATION, WRITING STYLE AND PRESENTATION OF MATERIAL
- REVISIONS CONSIDERED NECESSARY IN ORDER FOR THESIS TO BE ACCEPTED
- GENERAL COMMENTS

Your comments and explanations are extremely important and will:

- help the student prepare for the defence or make necessary revisions to the thesis (if revisions are required before the defence, a signed copy of your comments is provided to the candidate, the thesis supervisor, as well as to all members of the jury and the chair of the academic unit);
- allow the dean of FGPS to make an informed decision if the jury is divided; and
- allow the FGPS selection committee to choose recipients of prizes and medals.

PART C: RECOMMENDATION FOR A PRIZE

Do you recommend this thesis for a prize?

☐ YES – Please complete the attached NOMINATION FOR THESIS PRIZE form.

☒ NO

The absence of a reply will be considered a NO.

PART D: SIGNATURE

DATE 18 NOV 2012

SIGNATURE

M. Pierzynowski

PART E: DOCUMENTS

Please return all documents by email to thesis@uOttawa.ca or by fax to 613-562-5992 and send the originals in the enclosed self-addressed envelope to:

Thesis office
FGPS
Hagen Hall
115, Séraphin-Marion, Room 107
Ottawa ON K1N 6N5

Doctoral Thesis Examiner's Report for a Revised Thesis

Nicholas Ali, 5033260

Predicting risk factors of non-contact anterior cruciate ligament injuries during single-leg landing

PART A: Evaluation

Verdict 3: The revised thesis still cannot be accepted for the defence and must undergo additional extensive revision BEFORE DEFENCE to ensure it meets the above criteria

PART B: Comments

Understanding of the Subject Matter

As stated in the Abstract to the thesis, "The objective of this study (thesis) is threefold: first, conduct a gap study identifying the barriers to predicting mechanisms and risk factors to noncontact ACL injury. Second, propose a new approach that can address many of the challenges encountered in many existing non-contact ACL injury study approaches. Finally, whilst determining whether or not gender differences explain the higher rate of ACL injuries among females, identify and correlate the biomechanical and musculoskeletal variables significantly impacted by gender, vertical landing height, and/or horizontal landing distance and their interactions to various ACL injury risk predictor variables during single-leg landing.

The doctoral candidate has provided well-written reviews (Chapters 2 and 3) that summarize his understanding of the literature regarding his stated objectives 1 and 2. Evidence of an acceptable performance is that these two thesis chapters have been published in the "Open Biomedical Journal" and the "Transactions of the Canadian Society for Mechanical Engineering".

With respect to objective three, determine if gender differences explain the higher rate of ACL injuries among females, the thesis fails to provide sufficient rationale for its focus on examining gender. Previous thesis sections argue for a multi-disciplinary approach to simultaneously examine multiple risk for ACL injury. It is an abrupt focus shift.

And with respect to gender, the candidate fails to define "gender" and how it is a risk factor for ACL injury. Is the candidate talking about sex (dichotomous variable: male/female) or gender (an individual's self-perception of his/her male/female identity, continuous variable, say 0=super male, 10=super female, whatever that means to you or I)? I direct the candidate to the NIH guidelines regarding the definitions of sex and gender.

To continue, "What makes a male male! with respect to jumping/landing ability?" I might be sex=male but I would rate myself gender=2. This thesis is silent with regards to discussing the role of socialization with respect to jumping/landing ability. Gender identification seems to have at least face-validity according to this evaluator. Did the 6 males and 6 females, matched for age, height and weight, have similar or disparate physical activity profiles, opportunities to have learned a wide variety of physical activities, and did they have similar health status? If for example, the women tested in this study were gender=7 and the males gender=3 it is more difficult to determine if a "sex" difference exists. And as a additional point, the literature contains several papers that discuss the role of timing within a woman's cycle and her risk of ACL injury. The candidate mentions "hormones" several times within the thesis but was this data collected from the female participants.

Contribution of the Thesis to Advancing Knowledge

This thesis has the potential to contribute to the existing body of knowledge. The experimental methodology is sound but the data processing, statistics, and interpretation are weak. Although, Papers

III, IV and V have been submitted for publication, I believe they will not be accepted in their present form. Given that the "acid-test" to say something has advanced knowledge is publication in a peer-reviewed journal, this thesis, in its present form, does not meet this test.

Research Methodology

In Paper I the candidate performs a review of the literature to identify knowledge gaps related to predicting the mechanisms and risk factors of ACL injury. To identify the relevant literature, the candidate performed recent electronic literature searches and his databases selection and keywords are provided. He then states that "The most relevant full text English articles ... were analyzed". Unfortunately, the details regarding this selection are lacking. It is unclear if high quality evidence was selected using level and grade of evidence methodology or papers were selected that discussed the area of interest regardless of quality. Proper systematic review methodology was not used.

For papers III to V, the candidate used state-of-the-art instrumentation and methodology to measure selected biomechanical variables of the lower extremity during single-leg jumps. These data were processed using Visual3D and AnyBody software. Generally, the protocols are sufficiently documented so the findings could be replicated. However, a few details are lacking. For instance, why was the forceplate data collected at 1000 Hz in paper III when the kinematics data was collected at 250 Hz? In Paper III, the order of heights and distances were randomized to reduce learning effects. What evidence do you have that the order was random and it did reduce learning effects? One could use a Latin-square design to test if order is important and to remove it as a factor. The subjects were asked to jump from a box onto the middle of a force plate. The distance from the box to the edge of the edge force plate is mentioned but what is the size of the force plate? Paper IV, Figure 1a, b, c. Are these curves registered at peak VGRF? This information is not provided in the Procedures section.

Analysis of Results and Value of Conclusions

Point 1: The candidate provides a rationale why damage to the ACL may occur when the VGRF is at its maximum. He cites a paper by Cerulli et al (2002) that had one male healthy subject hopping and landing on one leg whilst *in vivo* measured ACL strain and externally measured GRF were collected. Cerulli et al present results that showed that peak ACL strain occurred when the GRF is maximal (abstract, text). [Note: Cerulli is unclear if he is talking about peak GRF or peak VGRF. I think it is peak VGRF looking at Figure 2. Nevertheless, the candidate should have pointed out this discrepancy]. However, it must be noted that Cerulli et al. (Figure 2) show that peak ACL strain occurred ~ 2% of the hop cycle after peak GRF. Since the hop cycle takes approximately 1.5 s (Cerulli page 309) the peak ACL strain occurs ~30 ms after peak GRF. It is surprising that the candidate did not comment on this abstract/text/figure discrepancy. In fact, the candidate states that the two events align (thesis page 13, 139), occur at the same instant (page 91), and occur at almost the same instant (page 114). The rationale for using peak VGRF as the point in the single-leg jump when the subject may be at greatest risk for ACL injury may be flawed. In addition, Cerulli et al talk about GRF not VGRF and one must assume that they mean VGRF,

The link between peak ACL strain and peak VGRF is of importance since the candidate performs all of his analyses (papers III, IV, V) at peak VGRF. As one can see in Figure 1a, b, c (paper IV), the only curves where time is not normalized, a 30 ms time shift can drastically alter the magnitude of the VGRF, PGRF, knee abduction moment. Examination of the time normalized curves in all of the papers also suggest drastic changes.

If we argue that peak ACL strain and peak VGRF align, the candidate provides no convincing argument that peak ACL strain is a risk factor for injury. Again, looking at Cerulli's paper, they state that their hopping task strains the ACL but "the point at which injury may occur is still unknown."

In this evaluator's opinion it is unfortunate the candidate short-changed himself by focussing on only one time point in the landing movement. This is stated for two reasons. First, a cursory examination of several curves within the thesis (i.e. Paper III, Figure 5b, 5c; knee flexion, hip flexion) clearly shows that the knee and hip variability at peak VGRF is quite small across the experimental conditions. The use of a more holistic representation of, for instance, the knee angles, might provide stronger evidence of male/female difference for Paper IV. Second, tissue (ACL) failure is not only dependent on peak

load/strain but also on rate of loading and prior loading history (hysteresis/creep). Examination of the rate of change of, for instance, knee flexion, may again provide stronger evidence of male/female difference.

Point 2: If one accepts that peak ACL strain is the major contributor to ACL failure, and peak ACL strain is strongly correlated to peak VGRF, what is the rationale for looking at trunk/hip/knee/ankle sagittal plane angles, frontal plane knee abduction moment? Some rationale is provided but these sections of the thesis must be strengthened.

Point 3: Within several Chapters of the thesis, Pearson Product Moment Correlations (PPMC) were used to identify the strengths of the associations between sets of variables. Unfortunately, no information is provided that states that this is the appropriate test. Were the data Normally distributed (tested using what test?) and if yes, then the PPMC is appropriate. If not, the Spearman Rank Correlation is appropriate. This lack of information suggests that maybe the data must be reanalyzed. I also suggest that in addition to the correlation values, scatterplots and variable histograms be provided for the reader's perusal. This presentation can be densely provided (lots of information in little space) using the statistical package R and using the pairs function.

Point 4: In a similar vein, the interpretation of a significant PPMC is not stated. For example, in Paper IV, Table 2, the PPMC between Peak VGRF and Ankle flexion, for the males, is -0.804 and this is flagged as significant at $P < 0.05$. The significance level indicates that the PPMC is different than zero but it does not state that the PPMC is, for instance, greater than 0.8 which might be the threshold at which it is important. A better statistic is to *a priori* state what is the minimal PPMC that one would accept as having evidence that an important association exists between two variables. The thesis lacks appropriate testable statistical hypothesis in this regard. Just stating that a PPMC is "reasonable" (page 108) is not acceptable. Lastly, confidence intervals about the point PPMC estimates should be provided.

Point 5: Within the thesis multiple comparisons are sometimes performed (i.e. Paper III using multiple ANOVAs). However, correction for multiple tests (i.e. Bonferroni's correction) is not performed. Marginal results should not be flagged as being significant (i.e. in Paper III horizontal jump distance has a significant effect on trunk flexion ($P = 0.04$)). The candidate must re-examine the results of the hypothesis testing, in light of a corrected P threshold, and then only discuss those findings that he is confident of being significant.

Point 6: In Paper V testable hypothesis are not stated. It is not sufficient to state that "... females will land with *relatively* greater peak VGRFs compared to males and ... males and females would demonstrate significantly *different* lower extremity joint reaction and muscle forces". What does *relatively* greater mean? What does *different* mean? Throughout the thesis all of the hypothesis must be converted to testable hypothesis and the results of parameter estimation (i.e. correlations) must state both point estimates and confidence intervals.

Organization, Writing Style and Presentation of Material

Overall, the formatting and grammar of the thesis is acceptable. However, the organization and data presentation is flawed.

Point 1: In my opinion, a significant limitation with this thesis, in regards to its organization, is the inclusion of Chapter 3 (Paper II) and associated sections that argue for the need for "a multidisciplinary design optimization approach [MDOA] to aid in the prediction of non-contact ACL injury mechanisms and risk factors" (abstract, Chapter 3). Although the need for a MDOA model is well argued, the candidate did not develop nor apply such an approach to answer his stated question. In my opinion, the candidate, promised and under delivered. A possible solution, however, is to delete Chapter 3 and all associated sections from the thesis (two examples: Chapter 1, page 17 ("One such technique that can allow a systems approach to solve complex problems is AI") and page 18 ("This proposed method suggests the coupling of many of the existing non-contact ACL injury study approaches via an AI technique. Details of this new proposed methodology are presented in journal Paper II (Ali et al. 2011).") and then re-organize what remains to stay within the boundaries of what was actually done.

Point 2: I am also concerned with data presentation. Several examples follow.

In paper III, the landing phase is defined to lie within the interval -0.8 s to +0.6 s relative to peak VGRF. So why in Figures 3, 4, 5's, and 6, is the VGRF at 58%? As a reviewer, I am asking myself the question "Is the data credible?" I am having difficulty answering this question since raw data is not provided. I strongly recommend that several not ensemble averaged (i.e. individual) data be plotted and that the raw data be provided within an Appendix.

The axis labelling for the profile plots in Paper IV (Figures 3, 4, 5, 6) should be near the axes and not within the Figure captions. I know this is how SPSS outputs profile plots but they should be better formatted.

Table 3 in Paper IV would best be presented in landscape mode and is the Table title correct. Are all of these dependent variables significantly influenced by height and distance interaction as well as main effects of gender, height and distance? Also examine the Tables in Paper V.

Table 4, paper V contains PPMC among risk predictor variables. It is not customary to include the 1.00's along the diagonal. Also see Table 4, Paper IV. I also add that it is customary to use *, ** and *** for P's < 0.05, 0.01, and 0.001 (i.e do not use #, \$)

A description of the subject characteristics is important. Self-perception of jumping ability, self-perception of gender, hormonal status, health status, and visual acuity should be included.

The Table of Contents is incomplete – no preliminary pages included, the Chapter titles are not included, no subsections included, no list of tables or figures, no Appendix and

Although I did not did not check all of your references I observed that (page 129) a series of references is missing (Colby, Decker, Kernozek. Ball).

Within two abstracts (i.e. Papers III, IV) the statistical test that is used for analysis is not stated.

In paper IV, the male and female participants had similar heights (1.72 vs 1.70 m) but dissimilar variance (0.11 vs 0.03 m) Is this a typographic error? If not, how is the reader to know that your height and mass matching was successful?

In Paper V, the capitalization on the title page is inconsistent relative to other Chapters.

In Paper V, several of the female findings (i.e. VGRF, Figure 5) are bimodal compared to the findings obtained from the males. How was the time normalization performed and is it wrong? If not, this finding must be discussed.

Revisions Considered Necessary in Order for Thesis to be Accepted

My recommended changes to the thesis are embedded within the report above. A brief (and incomplete) summary is:

Define gender versus sex and why gender is relevant.

Justify the selection of the biomechanical variables.

How were the papers selected for the Reviews of Literature assessed for quality?

Expand details regarding data collection and processing.

Is the PPMC the appropriate statistical test? Are the PPMC values correctly interpreted?

Thesis must contain raw data (plots, tables, Appendix) to allow reviewer to assess data quality.

Redo profile plots.

The hypotheses are not stated as testable hypotheses.

The interpretation of multiple statistical tests must use something like the Bonferroni correction.

Remove Paper II and all associated text within thesis.

Provide details regarding the subjects/participants tested.

Expand the Table of Contents. Add List of Figures, List of Tables

Check references for inclusion and correctness.

General Comments

I believe the thesis can make a contribution to knowledge since it embodies original investigation and analysis. However, in its present form, some justifications, some analyses, some presentations and some interpretations still require significant additions which I believe cannot be accomplished within a short time interval.

I thank you for the opportunity to read and comment on this thesis.

Michael Pierrynowski

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